CLAIMS

1. A process for fabricating a diffusion media, said process comprising:

providing a diffusion media substrate comprising a porous fibrous matrix defining first and second major faces, wherein said substrate comprises an amount of carbonaceous material sufficient to render said substrate electrically conductive;

applying a mesoporous layer along at least a portion of one of said first and second major faces of said substrate, wherein

said mesoporous layer is applied to said substrate by providing a coating comprising a hydrophobic component, a hydrophilic component, and a pore forming agent, and

said substrate is free of fluorinated polymers outside of regions of said substrate carrying said mesoporous layer; and

decomposing said pore forming agent such that said mesoporous layer is characterized by a porosity greater than a porosity of said diffusion media substrate.

2. A process as claimed in claim 1 wherein said hydrophobic component comprises a fluorinated polymer.

3. A process as claimed in claim 2 wherein said hydrophobic component comprises PTFE.

4. A process as claimed in claim 1 wherein said coating is provided as a mixture comprising between about 15 wt% and about 40 wt% of said hydrophobic component.

5. A process as claimed in claim 1 wherein said coating is provided as a mixture comprising about 20 wt% of said hydrophobic component.

6. A process as claimed in claim 1 wherein said hydrophilic component comprises a carbonaceous substance.

7. A process as claimed in claim 6 wherein said carbonaceous substance is selected from carbon fibers, carbon particles, and combinations thereof.

8. A process as claimed in claim 6 wherein said carbonaceous substance is characterized by a surface area of between about 50 cm^2/g and about 250 cm^2/g.

9. A process as claimed in claim 6 wherein said carbonaceous substance is characterized by a surface area of about 60 cm^2/g.

10. A process as claimed in claim 6 wherein said carbonaceous substance comprises acetylene black.

11. A process as claimed in claim 1 wherein said coating is provided as a mixture comprising between about 60 wt% and about 85 wt% of said hydrophilic component.

12. A process as claimed in claim 1 wherein said coating is provided as a mixture comprising about 80 wt% of said hydrophilic component.

13. A process as claimed in claim 1 wherein said pore forming agent comprises a material selected such that said mesoporous layer is substantially free of components of said pore forming agent upon decomposition of said pore forming agent.

14. A process as claimed in claim 1 wherein said pore forming agent comprises a material selected to decompose in a mixture with said hydrophobic and hydrophilic components upon heating above room temperature.

15. A process as claimed in claim 14 wherein said pore forming agent comprises a material selected such that said decomposition is particulate free.

16. A process as claimed in claim 14 wherein said pore forming agent comprises a material selected such that said decomposition comprises gaseous and liquid components.

17. A process as claimed in claim 14 wherein said pore forming agent comprises a material selected such that said decomposition comprises at least one gaseous component and H_2O.

18. A process as claimed in claim 1 wherein said pore forming agent comprises ammonium carbonate.

19. A process as claimed in claim 1 wherein said coating is provided as a mixture comprising between about 0 wt% and about 15 wt% of said pore forming agent.

20. A process as claimed in claim 1 wherein said coating is provided as a mixture comprising about 5 wt% of said pore forming agent.

21. A process as claimed in claim 1 wherein a sufficient amount of said mesoporous layer is applied to said substrate to substantially increase a porosity of said diffusion media relative to said diffusion media absent said mesoporous layer.

22. A process as claimed in claim 21 wherein said substantial increase in said porosity of said diffusion media is between about 5% and about 15%.

23. A process as claimed in claim 21 wherein said substantial increase in said porosity of said diffusion media is about 7.5%.

24. A process as claimed in claim 21 wherein said porosity of said diffusion media including said substrate and said mesoporous layer is about 84%.

25. A process as claimed in claim 1 wherein said coating further comprises a solvent selected from H_2O, isopropanol, and combinations thereof.

26. A process as claimed in claim 1 wherein said coating is provided such that it at least partially infiltrates said diffusion media substrate.

27. A process as claimed in claim 1 wherein a sufficient amount of said mesoporous layer is applied to said substrate to substantially increase an overall porosity of said diffusion media from about 78% absent said mesoporous layer to about 84% including said mesoporous layer.

28. A process as claimed in claim 1 wherein a sufficient amount of said mesoporous layer is applied to said substrate to yield a mesoporous layer thickness of between about 10μm and about 25μm.

29. A process as claimed in claim 28 wherein said diffusion media substrate is provided having a thickness of between about 100μm and about 300μm.

30. A process as claimed in claim 1 wherein said pore forming agent is decomposed by a heat treating process.

31. A process as claimed in claim 30 wherein said heat treating process is characterized by temperatures between about 75°C and about 100°C.

32. A process as claimed in claim 30 wherein said heat treating process is characterized by temperatures above about 65°C.

33. A process for fabricating a diffusion media, said process comprising:

providing a diffusion media substrate comprising a porous fibrous matrix defining first and second major faces, wherein said substrate comprises an amount of carbonaceous material sufficient to render said substrate electrically conductive;

applying a mesoporous layer along at least a portion of one of said first and second major faces of said substrate, wherein

said mesoporous layer is applied to said substrate by providing a coating comprising a hydrophobic component, a hydrophilic component, a pore forming agent, and a solvent,

said hydrophobic component comprises a fluorinated polymer,

said hydrophilic component comprises a carbonaceous substance selected from carbon fibers, carbon particles, and combinations thereof,

said carbonaceous substance is characterized by a surface area of about 60 cm^2/g,

said pore forming agent comprises ammonium carbonate,

said substrate is free of fluorinated polymers outside of regions of said substrate carrying said mesoporous layer,

a sufficient amount of said mesoporous layer is applied to said substrate to substantially increase a porosity of said diffusion media relative to said diffusion media absent said mesoporous layer,

said substantial increase in said porosity of said diffusion media is between about 5% and about 15%,

said solvent is selected from H_2O, isopropanol, and combinations thereof, and

said coating is provided such that it at least partially infiltrates said diffusion media substrate; and

decomposing said pore forming agent in a heat treating process such that said mesoporous layer is characterized by a porosity greater than a porosity of said diffusion media substrate.

34. A device comprising a diffusion media wherein:

said diffusion media comprises a diffusion media substrate and a mesoporous layer;

said diffusion media substrate comprises a porous fibrous matrix defining first and second major faces and an amount of carbonaceous material sufficient to render said substrate electrically conductive;

said diffusion media substrate carries said mesoporous layer along at least a portion of one of said first and second major faces of said substrate;

said mesoporous layer comprises hydrophobic and hydrophilic components defining hydrophobic and hydrophilic regions within said mesoporous layer;

said mesoporous layer comprises an amount of carbonaceous material sufficient to render said mesoporous layer electrically conductive;

said mesoporous layer is characterized by a porosity greater than a porosity of said diffusion media substrate; and

said diffusion media substrate is free of fluorinated polymers outside of regions of said substrate carrying said mesoporous layer.

35. A device as claimed in claim 34 wherein said mesoporous layer is characterized by pore sizes between about 1nm and 1μm.

36. A device as claimed in claim 34 wherein:

said hydrophobic component comprises a fluorinated polymer;

said hydrophilic component comprises a carbonaceous substance selected from carbon fibers, carbon particles, and combinations thereof;

said carbonaceous substance is characterized by a surface area of about 60 cm2/g;

said mesoporous layer at least partially infiltrates said diffusion media substrate;

said diffusion media substrate is characterized by a porosity of about 78% outside regions of said substrate carrying said mesoporous layer; and

said diffusion media is characterized by an overall porosity of about 84%.

37. A device as claimed in claim 34 wherein said device further comprises structure defining a fuel cell employing said diffusion media.

38. A device as claimed in claim 37 wherein said device further comprises structure defining a vehicle powered by said fuel cell.